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An evaluation of the College Algebra Placement Test as an instrument for the placement of students in certain classes and in sections within these classes. "The purpose of this study is to first evaluate the test for the uses made of it—primarily in terms of its prognostic value—and second, upon finding reasonable validity of the test, to provide more specific cut-off data to facilitate its use for these purposes."

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AN EVALUATION OF THE "COLLEGE ALGEBRA PLACEMENT TEST" IN TERMS OF MATHEMATICS SUCCESS IN THE ENGINEERING SCHOOL

A. Introduction

The Institute of Technology has for a number of years been administering the College Algebra Placement Test to incoming freshmen students. The results of the test have been utilized to a great extent in the placement of students into MT-1, MT-15, and MT-17, as well as in the sectioning of students within each class. To the present no follow-up study of the effectiveness of the test for these purposes has been made.

The purpose of this study is to first evaluate the test for the uses made of it--primarily in terms of its prognostic value--and second, upon finding reasonable validity of the test, to provide more specific cut-off data to facilitate its use for these purposes.

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B. Procedure With Results

1. The Relation Between Test Score and Grades

Since about 80% of the I.T. freshmen are placed into MT-1, this course provided the only adaquate number of individuals upon which to make the evaluation. Using the entering freshmen from the years 1950-51, 1951-52, 1952-53, and 1953-54 a total of 209 individuals were available for whom both test score and grade in MT-1 could be obtained. This group consequently served as the sample for the study.

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As a first step in the analysis, separate distributions of test scores (recorded in terms of total percentile scores) were formed for individuals having attained grades of A, B, C, and D or F in MT-1. The categories of D and F were combined in view of the fact that only 2 grades of F were recorded among the 209 individuals over the four year period covered. The distribution of scores is given in table 1 which follows, and is shown graphically in Graph 1.

Table 1. Distribution of Test Scores for Individuals Later Attaining Grades of A, B, C, and D or F. Based on 4 year period 1950-54.

Test Score Interval	Frequency of Scores for Individual Attaining			
	A's	B's	C's	D's or F's
99	𝍸	I		
97 - 98	𝍸 IIII	𝍸 𝍸 𝍸	I	I
95 - 96	𝍸 I	IIII	II	I
93 - 94	III	𝍸	𝍸	
91 - 92	II	𝍸	III	
89 - 90	I	𝍸 II	𝍸 II	I
87 - 88		II	IIII	
85 - 86	I	𝍸	I	I
83 - 84		II	I	
81 - 82		I	I	II
79 - 80		III	IIII	
77 - 78			I	
75 - 76	I		𝍸	
73 - 74			II	
71 - 72		II	I	III
69 - 70		III	IIII	I
67 - 68		II	IIII	III
65 - 66			𝍸 I	
63 - 64			𝍸	I
61 - 62	I	I		II
59 - 60		II	III	
57 - 58				II
55 - 56			II	
53 - 54			III	II
51 -52			III	
49 - 50		III	III	I
47 - 48			IIII	III
45 - 46			I	II
43 - 44				III
41 - 42				
40 & below			III	I
	$\bar{X}$ = 94.6	$\bar{X}$ = 86.9	$\bar{X}$ = 70.9	$\bar{X}$ = 62.3

In glancing at table 1, it can be seen that the general level of test scores is higher for each successive group of individuals attaining higher achievement in MT-1. Only 3 out of 34 individuals attaining a grade of A in MT-1 had test scores below the 90th percentile, and only 3 of 31 individuals making grades of D or F had test scores above this 90th percentile. Only 2 out of 34 individuals making grades of A's fell below the 80th percentile and only 15 out of 61 (25%) of those making grades of B's fell below this 80th percentile; while 50 out of 80 (or 62%) of those making C's and 26 out of 30 (or 83%) of those making D's or F's scored below this 80th percentile.

The mean percentile scores on the test for the different grade categories were 94.58, 86.90, 70.95 and 62.33 for the grade categories of A, B, C, and D or F respectively. A better notion of the differences in the distributions can be gained by observing the graphs in Graph 1 (pointed to probabilities, but giving an approximate shape of the distributions).

To obtain the relationship in more conventional terms, the data was distributed into a 6 X 4 contingency table and the coefficient of correlation "C" (contingency coefficient) was determined. The contingency table appears as Table 2 which follows. Grouping of the test scores into the 6 categories was performed following the principal of having a minimum of 10% of the total frequencies in each category. The resulting coefficient of correlation was $\neq .581$, significant beyond the 1% level of confidence. The relationship is as high as can be

expected in the prediction of any aspect of human behavior.

Table 2. Contingency Table Reflecting Relationship Between Test Scores and Success in MT-1.

		Freq. Grades Attained in MT-1				
		A	B	C	D or F	Total
Freq. of Math. Test %-tile Scores	97-100	19	16	1	1	37
	93-96	10	9	8	1	28
	89-92	3	12	10	1	26
	79-88	1	13	11	3	28
	63-78	1	7	28	9	45
	62 & below	1	6	22	16	45
	Totals	35	63	80	31	209

C = ⁄.581

2. Determining Probability Norms for the Engineering School Situation

With the prognostic efficiency of the test determined, an attempt was made to determine more specific means upon which decisions of placement could be made.

For this purpose, successive groups of intervals were formed, and in each, the relative proportion of individuals attaining the various grades was determined. Thus, considering scores falling between 97 and 100 on the test, a total of 37 individuals were distributed into the grade categories. Of these 37 individuals, 51% attained A's, 43% attained B's, 3% attained C's, and 3% attained either D's or F's. By

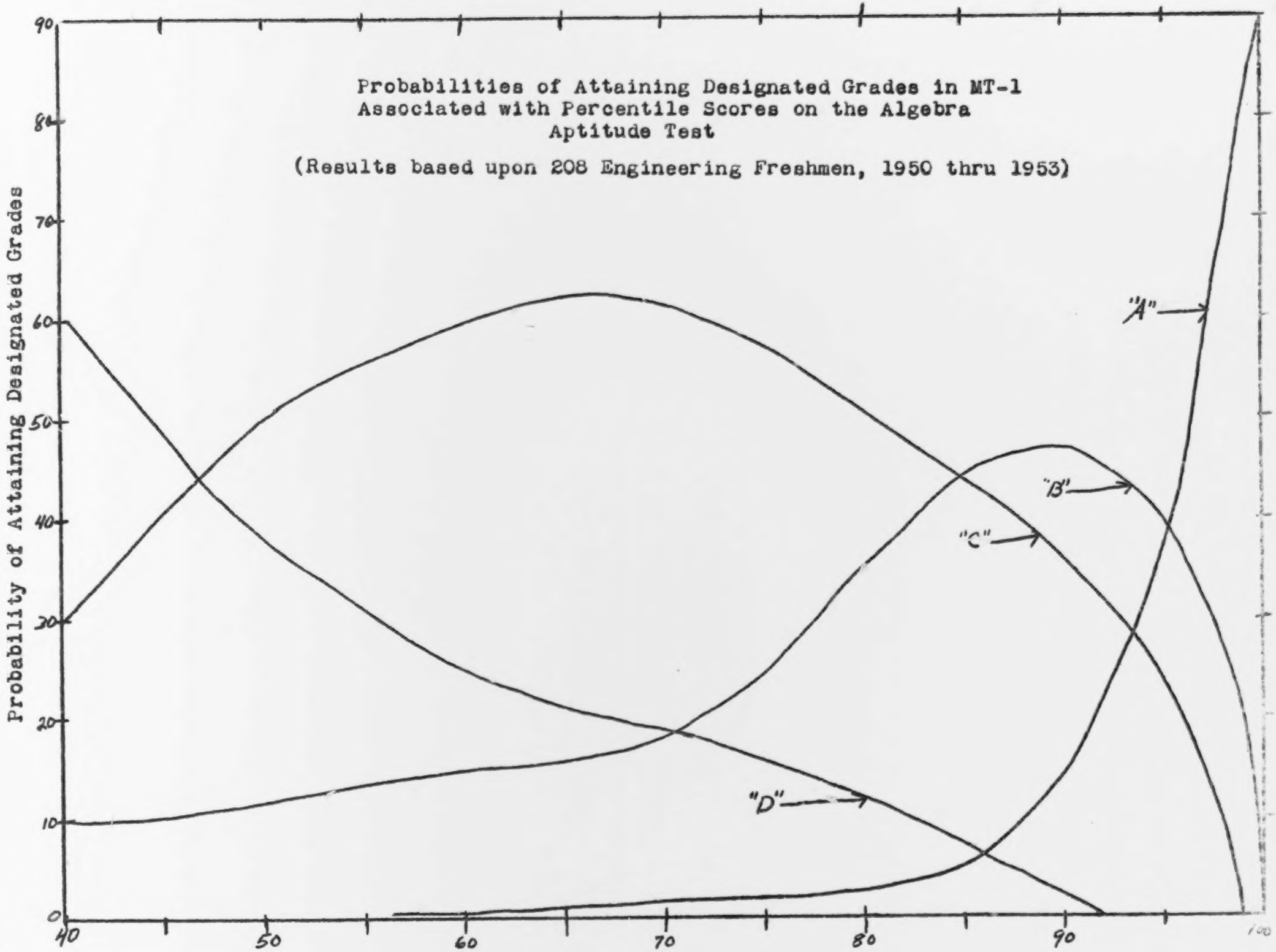
continuing this process throughout the entire range of test scores, plotting the resulting probabilities on graph paper, and smoothing the curves, the probability graphs presented in Graph 1 of this report were formed. From the graph (appearing on the next page), the probability of attaining each grade can be determined for any test score. As an example, reading probabilities from the graph for an individual making a test score at the 90th percentile, we can see that chances are 15% that he will later attain an A, 47% that he will attain a B, 36% that he will attain a C, and only 2% that he will attain a D or F.

A closer glance at the probability curves provides added information regarding the relation between test score and later success. For very high scores (95 and above) the strongest odds favor a grade of A, with lesser chances for either a B or a C, and practically no chance that the student will attain a grade lower than C. Then, for scores between 85 and 95, odds favor a grade of B, with the odds for an A increasing as the score approaches the upper limit of this interval, and the odds for a C increasing as the score approaches the lower limit of the interval. A relatively lower chance for a D or F appears as an increasing trend as scores approach the lower limit.

As scores decrease from 85 down to about 45, heaviest chances are associated with a grade of C. As the score lowers from 85 the chances for a B become smaller and those for an A become almost negligible. At the same time, the chances for a D or F begin increasing rapidly--particularly for scores below

Probabilities of Attaining Designated Grades in MT-1
Associated with Percentile Scores on the Algebra
Aptitude Test

(Results based upon 208 Engineering Freshmen, 1950 thru 1953)



the 60th percentile. Below a score of 47, the chances are the strongest for a grade of D or F, with decreasing chances for a C, and 10% or less chance to attain a B.

For convenience, a number of specific probabilities associated with a number of selected points have been read from the graph and are recorded in table 3 which follows.

Table 3. Probabilities of Attaining Various Grades in MT-1 when Entrance Math Test Percentile falls at selected points

%-tile score on Math Test	Associated probability of attaining grade				
	A	B	C	D or F	Total
99	80	20	-	-	100
95	37	40	23	-	100
90	15	47	36	2	100
85	5	44	44	7	100
80	3	35	50	12	100
75	2	24	57	15	100
70	2	18	61	19	100
65	1	16	62	21	100
60	1	15	59	25	100
55	-	14	55	31	100
50	-	12	50	38	100
45	-	10	41	49	100
40	-	10	30	60	100